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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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FISH & RICHARDSON P.C. P.O BOX 1022 MINNEAPOLIS, MN 55440-1022			EXAMINER FOTAKIS, ARISTOCRATIS	
			ART UNIT 2611	PAPER NUMBER
			NOTIFICATION DATE 09/08/2009	DELIVERY MODE ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATDOCTC@fr.com

### Office Action Summary

**Application No.**

10/799,543

**Applicant(s)**

HAN ET AL.

**Examiner**

ARISTOCRATIS FOTAKIS

**Art Unit**

2611

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 07/03/2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1, 4 - 7, 10 - 14, 16 - 17, 20- 21, 23 - 24 and 26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 4 - 7, 10 - 14, 16 - 17, 20- 21, 23 - 24 and 26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 13 – 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Cideciyan et al (US 6,377,635).

Re claim 13, Cideciyan teaches of an apparatus comprising: a branch metric generator that generates branch metrics comprising a cross-correlation (equations 3 and 4) for a partial response channel (branch metrics, Figs 2 - 14); an add-compare-select component (Figs.20 - 21) that compares paths (#2002, Fig.20) and determines survivor paths (SEL, Figs.20 – 21) using generated branch metrics; a memory that retains metrics information (LATCH, Fig.20); and a trace-back component that determines a best path of the survivor paths and outputs sequence information based on the determined best path (*a traceback component is inherent in viterbi detection*). wherein the partial response channel having a transfer function defined according to a target polynomial,  $T(D)=p_0 + p_1D + \dots + P_M D^M$  ( $F(D)$ , Col 4, Lines 11 - 12) the Viterbi

detection operates according to a trellis having  $2^M$  states ( $2^L$  states, Col 3, lines 28 - 33), and all survivor paths associated with all the  $2^M$  states in the trellis merge in  $M$  steps (Figs.8 - 14).

Re claim 14, Cideciyan teaches of wherein the add-compare-select component compares paths and determines survivor paths by maximizing a quantity (*minimizing the metric by minimizing a negative data dependent term (the first sum of equation 3)*) defined according to an equation,  $\sum_{k=0}^N y_k \cdot y_k^*$ , where  $N$  corresponds to a sequence length,  $y_k$  corresponds to a real channel output, and  $y_k^*$  corresponds to an estimated channel output (equations 3 and 4, Col 4, Lines 20 – 44).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 4 – 7, 10 – 12, 17, 20 – 21, 23 – 24 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cideciyan et al (US 6,377,635) in view of Fisher et al (US 6,249,398).

Re claims 1, 7 and 17, Cideciyan teaches of a method and a machine-readable medium (Col 1, Lines 20 – 34, Fig.10) embodying information indicative of instructions for causing one or more machines to perform operations comprising: obtaining an output signal sequence ( $y_n$ , equation 1) from a partial response channel (PR); determining an input sequence ( $\{\hat{a}_n\}$ , Col 4, Lines 10 - 20) of the partial response channel by maximizing (*minimize the metric*, Lines 21 - 50) a cross-correlation of an

estimated output sequence with the obtained output sequence (the first sum of equation 4) *(The first sum of equation 4 (cross-correlation) is the only data-dependent term or time-varying term of the equation and to minimize the negative first term is by maximizing the crosscorrelation)*, and providing an output corresponding to the determined input sequence (Col 10, Lines 58 – 67, Fig.2); wherein said determining the input sequence comprises employing Viterbi detection (Abstract) using a cross-correlation branch metric (Col 3, Lines 23 – 43); and wherein the partial response channel having a transfer function defined according to a target polynomial,  $T(D)=p_0+p_1D+\dots+P_MD^M$  ( $F(D)$ , Col 4, Lines 11 - 12) the Viterbi detection operates according to a trellis having  $2^M$  states ( $2^L$  states, Col 3, lines 28 - 33), and all survivor paths associated with all the  $2^M$  states in the trellis merge in  $M$  steps (Figs.8 - 14). However, Cideciyan does not specifically of the Viterbi detection providing a robust tolerance of phase uncertainty with the waveform of widely varying amplitude including providing accurate detection decisions even when the amplitude of the waveform is very small.

Fisher teaches of a new class of fixed partial response targets for use in a PRML magnetic medium read channel (Abstract, Lines 1 – 2). To properly equalize and detect the user-data bits, several parameters must be adaptively controlled. The sample values at node (#54, Fig.2) are applied to an error generator circuit (#64, Fig.2) where they are compared to the ideal target response values. These values are in accordance with a  $7+4D-4D^2-5D^3-2D^4$  polynomial. These values are relative and they may be scaled to the A/D output bits as appropriate. The error generator (#64) provides an error signal via (#66) to gain control circuitry (#68), which in turn controls the variable gain

filter (#42, #68 controls the amplitude variations). The error generator 64 also provides input via path (#67) to timing control circuitry (#70), which in turn adjusts the sampling phase of the sampler (#46, providing a robust tolerance of phase uncertainty) (Fig.2, Col 6, Lines 20 – 43) in order to have accurate detection decisions (Viterbi Detector, #60) even when the amplitude of the waveform is very small (it is inherent that *gain control would control the gain of a signal of a predetermined amplitude range (smallest amplitude to largest amplitude)*).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have provided a time control circuitry in order to control any phase changes and a gain control circuitry to control undesired amplitude variations of the signal for improving signal acquisition performance in a disk drive read channel.

Re claims 4, 10 and 20, Cideciyan teaches of providing the output corresponding to the determined input sequence comprises providing the determined input sequence to an additional sequence-processing component (ACS, Figs.20 and 21).

Re claims 5 and 11, Cideciyan teaches of the output signal sequence ( $y_n$ ) comprising a convolution of the input sequence and a target polynomial of the partial response channel (equation 1, Col 4, Lines 4 - 15).

Re claims 6 and 12, Cideciyan teaches of the partial response channel comprising a data storage medium (Col 1, Lines 8 – 15), and said obtaining the output

signal sequence comprises sampling a signal generated from the data storage medium ( $1/T$  sample rate, Col 4, lines 1 – 3).

Re claims 21 and 24, Cideciyan teaches of a data storage system (Col 1, Lines 8 – 15) comprising: an input line that provides a sampled channel sequence ( $y_n$ , equation 1); Viterbi detection means for determining a recovered sequence ( $\{\hat{a}_n\}$ , Col 4, Lines 10 - 20) from the sampled channel sequence ( $y_n$ , Col 4, Lines 4 - 20), the Viterbi detection means including means for maximizing cross-correlation of the recovered sequence and the sampled channel sequence (first sum, equations 3 and 4, *minimizing the metric by minimizing a negative data dependent term (the first sum of equation 3)*). However, Cideciyan does not specifically of the Viterbi detection providing a robust tolerance of phase uncertainty with the waveform of widely varying amplitude including providing accurate detection decisions even when the amplitude of the waveform is very small.

Fisher teaches of a new class of fixed partial response targets for use in a PRML magnetic medium read channel (Abstract, Lines 1 – 2). To properly equalize and detect the user-data bits, several parameters must be adaptively controlled. The sample values at node (#54, Fig.2) are applied to an error generator circuit (#64, Fig.2) where they are compared to the ideal target response values. These values are in accordance with a  $7 + 4D - 4D^2 - 5D^3 - 2D^4$  polynomial. These values are relative and they may be scaled to the A/D output bits as appropriate. The error generator (#64) provides an error signal via (#66) to gain control circuitry (#68), which in turn controls the variable gain



filter (#42, #68 controls the amplitude variations). The error generator 64 also provides input via path (#67) to timing control circuitry (#70), which in turn adjusts the sampling phase of the sampler (#46, providing a robust tolerance of phase uncertainty) (Fig.2, Col 6, Lines 20 – 43) in order to have accurate detection decisions (Viterbi Detector, #60) even when the amplitude of the waveform is very small (it is inherent that *gain control would control the gain of a signal of a predetermined amplitude range (smallest amplitude to largest amplitude)*).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have provided a time control circuitry in order to control any phase changes and a gain control circuitry to control undesired amplitude variations of the signal for improving signal acquisition performance in a disk drive read channel.

Re claims 23 and 26, Cideciyan teaches of a head-disk assembly comprising the input line (direct access storage device, Col 1, Lines 8 – 15, *a head-disk assembly is included in a direct access storage device*).

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cideciyan in view of McEwen et al (US 6,366,418).

Cideciyan teaches all the limitations of claim 13 except of the memory comprising a path memory of length M.

McEwen teaches of partial response channel having a transfer function defined according to a target polynomial,  $T(D)=p_0 + p_1D + \dots + p_M D^M$  (Col 1, Lines 35 - 62) the Viterbi detection operates according to a trellis having  $2^M$  states ( $2^s$  states, Col 5, Lines 10 - 65) wherein the path memory length is M (S, Col5, Lines 10 - 35).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have a path memory length reduced in size to enable a greater number of sectors to be recorded on the magnetic disk surface (Col 3, lines 20 - 25).

### ***Response to Arguments***

Applicant's arguments filed July 01, 2009 have been fully considered but they are not persuasive.

Applicants admit that the equations in Cideciyan show the cross-correlation term. Applicants submit that the cross-correlation is not used as claimed, wherein in the presently claimed invention corresponds to a cross-correlation of obtained output sequences and estimated output sequences for a partial response channel. Cideciyan does not teach using the claimed cross-correlation in the branch metrics generated by a branch metric generator, which branch metrics are then used by an add-compare-select

component to determine survivor paths. The branch metrics generated for use by the add compare select (ACS) unit in Cideciyan explicitly do not include a cross-correlation of obtained output sequences and estimated output sequences.

Examiner submits that Cideciyan teaches of the crosscorrelation as admitted by the Applicant. The Metric in equation 3 or 4 includes a crosscorrelation term and a constant term. The cross-correlation term is referred to as the data-dependent or time varying term. Figures 3 – 13, shows the trellis performing ACS (Add-Compare-Select) operations to find the updated state metrics by using branch metric data dependent terms. Therefore, Cideciyan teaches of the branch metrics used by an add-compare-select component to determine survivor paths.

Applicants submit that Cideciyan does not describe determining an input sequence of the partial response channel by maximizing cross-correlation of an estimated output sequence with the obtained output sequence.

Cideciyan teaches of minimizing the metric of equation 3. Since the data dependent term is negative, it would be required to maximize the cross-correlation in order to minimize the metric.

Applicants have submitted that Fisher fails to disclose Viterbi Detection that provides a robust tolerance of phase uncertainty with a waveform of widely varying amplitude. Applicants further submit that the components 64, 67, 70 and 46 are clearly separate from the Viterbi detector 60.

Examiner submits that Fisher discloses of a timing recovery unit to provide a robust tolerance of phase uncertainty to the signal inputted in the Viterbi detector from the loop as shown in Figure 2. Eventhough, the error generator is outside the Viterbi Detector, the error generator is coupled to the Viterbi Detector and the robust tolerance of phase uncertainty performed by the Timing Control is based on both the input and output of the Viterbi detector (output of the error generator).

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until **after** the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aristocratis Fotakis whose telephone number is (571) 270-1206. The examiner can normally be reached on Monday - Friday 07:00 - 16:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chieh M. Fan can be reached on (571) 272-3042. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Aristocratis Fotakis/

Examiner, Art Unit 2611

/Chieh M Fan/

Supervisory Patent Examiner, Art Unit 2611